A METHOD OF CONNECTING A PASSENGER BRIDGE TO AN AIRCRAFT, AND AN ARRANGEMENT TO THIS END.

The present invention relates to a method of connecting a passenger bridge to an aircraft, and to an arrangement for this end.

Many airports now include passenger bridges which are connected to an aircraft from a terminal building and via which passengers embark and disembark. Several different types of passenger bridges are known to the art, of which one is a so-called Mobile Telescopic Bridge (MTB) which comprises a number of telescopic parts where the outmost part is supported by a bogie that has separately driven wheels. The bogie functions to manoeuvre the passenger bridge on the airport hardstanding towards and away from an aircraft. Located at the connection of the passenger bridge to a terminal building is a rotunda which is rotatable about a vertical axis and which is supported by a ground-anchored pillar. Located in the outermost part of the passenger bridge is a cabin that can be rotated relative to the outermost telescopic element of said bridge. The cabin is that part of the arrangement intended for connection to the door of an aircraft.

A serious problem resides in the relatively long time taken for passengers to board the aircraft and also to disembark passengers, when the aircraft is parked at a so called gate. This means that the time lapse from the time at which the aircraft has landed to the time at which it can re-start is unnecessarily long, which is both uneconomic and causes the passengers to feel that they are forced to wait unnecessarily.

It is undesirable for passengers to wait on the hardstanding, for safety reasons.

Aircraft tend to be both larger and longer. A serious technical problem arises with regard to connecting a telescopic passenger bridge to a rear door that is located sternwards of a wing of an aircraft, due to the significant distance from the rotunda to a rear door. This distance can exceed 30-40 metres. There is found in this respect a solution in which the passenger bridge is suspended from a device that likens a crane, so that the bridge is able to extend

stably over the wing to an extent that enables the bridge to be connected to a rear door of the aircraft. This solution is both clumsy and expensive.

Another solution is described in Swedish patent specification 513 504. According to this patent specification, the passenger bridge is given mobility through the medium of a drive means arranged in the outer part of the bridge and having wheels rest against the airport hardstanding, wherein the passenger bridge includes telescopic parts. According to this patent specification, the passenger bridge is driven by the drive means after an aircraft has parked, so as to cause the drive means and the outer part of the passenger bridge to pass outwardly of said aircraft wing and then in behind said wing for connection to the rear door of the aircraft.

Although this provides a conceivable solution to the aforesaid problem, it itself, causes a problem with regard to present-day large aircraft, such as Airbus 380 which have two flight decks. In addition to requiring a passenger bridge in excess of 50 metres in length in order to move around the wing, the time taken to connect the bridge to a rear door would be unacceptably long. Moreover, the location of bridge connection to the rotunda at the airport building would be much too high for the bridge to be connected to a rear door on the lower flight deck and therewith pass freely over the wing of the aircraft. The outermost part of the wing of an Airbus 380 is namely situated at a greater height above the ground than the doors on the upper deck.

The present invention solves this problem and provides a simple and convenient solution to the problem of connecting a passenger bridge to a rear door on the upper deck of a two-deck aircraft and also on the lower deck of such an aircraft.

Accordingly, the present invention relates to a method of connecting the outer end of a passenger bridge to a door on the body of an aircraft, said door being located on one side of the aircraft and sternwards of an aircraft wing, wherein the inner part of the passenger bridge is connected to a terminal building via a rotunda, wherein the outer part of the passenger bridge carries a cabin intended for connection to the aircraft at a door thereof, wherein the passenger bridge is mobile through the agency of a drive means that rests

against a hardstanding at the airport, at the airport through the medium of wheels included in said drive means, wherein the passenger bridge includes telescopic parts, and wherein the method is characterised by locating the drive means at the outer end of the inner part of the passenger bridge; by enabling the outer part of the passenger bridge to swing in a vertical plane relative to the inner part of said bridge; by driving the passenger bridge from a parking position to a docking position by means of said drive means after an aircraft has parked for connection to the passenger bridge, and by positioning the drive means close to the leading edge of the aircraft wing while telescoping the inner part of the passenger bridge, and by thereafter swinging down the outer part of the passenger bridge and telescoping said outer part to an end position in which said cabin can be docked with the aircraft body.

The present invention also relates to an arrangement of the kind having the main features set forth in the accompanying claim 5.

The present invention will now be described in more detail partly with reference an embodiment of the invention illustrated in the accompanying drawings, in which

fig. 1 is a side view of an Airbus A380;

fig. 2 shows the aircraft and passenger bridges from above;

fig. 3 shows a passenger bridge connected to a rear door A4 on the lower deck of the aircraft;

fig. 4-6 illustrate the procedural steps of connecting the passenger bridge of fig. 3 to the aircraft;

fig. 7 is a sectional view of the passenger bridge taken at the drive means and shows the placement of the bridge in relation to the aircraft;

fig. 8 shows three passenger bridges connected respectively to a rear door A4 on the lower deck and two front doors A2 A7 on the lower and the upper deck respectively;

fig. 9 shows a passenger bridge connected to a rear door A8 on the upper deck of the aircraft;

fig. 10-12 illustrate the procedural steps taken in connecting the passenger bridge of fig. 9 to the aircraft;

fig. 13 shows three passenger bridges connected to a rear door A8 on the upper deck and to two forwardly located doors A1 and A2 on the lower deck, respectively;

fig. 14 is a side view of a passenger bridge connected to a forwardly located door on the upper deck;

fig. 15 is a side view of a passenger bridge connected to a forwardly located door on the lower deck; and

fig. 16 illustrates a detailed figure of a region in which the passenger bridge can be folded in a vertical plane.

Fig. 1 is a side view of an aircraft designated Airbus A 380, where the doors A1 –A5, A7-A9 have been marked.

Fig. 2 shows the aircraft 1 and passenger bridges 2, 3, 4 from above.

The present invention relates to a method of connecting the outer end 5 of a passenger bridge 4 to a door A4, A5, A8, A9 on an aircraft body, said door being located on one side of the aircraft and aft of the aircraft wing 6 wherewith the inner part 7 of the bridge is connected to a terminal building 8 via a rotunda 9, and wherewith the outer part 10 of the bridge carries a cabin 11 which is intended for connection to a door on the aircraft.

The passenger bridge 4 is given mobility through the agency of a drive means 12 which rests against the airport hardstanding 15 through the medium of wheels 13, 14 (see fig. 5 and 7), said bridge 4 including telescopic parts 16, 17, 18, 19 as shown in fig. 6.

According to the invention, the drive means 12 is located at the outer end of the inner part 7 of the bridge 4. The outer part 10 of the passenger bridge can be swung in a vertical plane relative to the inner part 7 of the bridge.

When an aircraft has parked for connection to the passenger bridge 4, the bridge 4 is moved by the drive means 12 from a parking position, shown in fig. 2, to a docking position, shown in fig. 3, in which the drive means 12 is positioned close to the leading edge 20 of the aircraft wing 6 while telescoping the inner part 7 of the bridge. The outer part 10 of the bridge is then swung downwards relative to the inner part 7 of the bridge and telescoped to an end position in which the cabin 5 can be docked to the aircraft body, see fig. 3.

The outer end of the passenger bridge is thus adapted for connection to a door on the body of the aircraft, said door being located on one side of the aircraft and sternwards of the aircraft wing 6. This outer end is normally designated the cabin 5 and can be swung about a vertical axis to take a position parallel with the aircraft body. The cabin 5 is also restricted telescopically for movement of the cabin to a position in which it lies adjacently around the door on the body of the aircraft.

The inner end 7 of the passenger bridge is connected to a terminal building 8. This connection is designed for connection of the inner end of the bridge to the terminal building via at least one rotunda 9 and a further element 21 for pedestrian traffic.

As before mentioned, the passenger bridge 4 is made mobile through the agency of a drive means 12 provided on the outer part of the bridge. The drive means 12 is of a known kind and rests against the airport hardstanding 15 through the medium of wheels 13, 14, wherein the wheels are preferably driven individually. The drive means enables the passenger bridge to be driven in any desired direction. The passenger bridge also includes, as known

per se, telescopic parts, i.e. telescopic elements in the form of tunnel-like elements that are generally rectangular in cross-section.

The telescopic construction and the design of the drive means described above are well known to the art and will not therefore be described in more detail.

The telescopic elements 16, 17 of the inner part of the passenger bridge are extended and withdrawn respectively as the passenger bridge is moved along the hardstanding 15 by the drive means.

The telescopic elements 18, 19 of the outer part of the passenger bridge are extended and withdrawn respectively with the aid of a suitably known drive means (not shown) that functions to extend and withdraw respectively the outer telescopic element 19 from and into the inner telescopic element 18.

According to one preferred embodiment of the invention, the outer part 10 of the passenger bridge is hinged to the inner part 7 of said bridge, i.e. the parts 17 and 18 of the bridge are hinged together so as to enable the bridge to be folded in a vertical plane, as shown in fig. 16.

The vertical position of the outer bridge part 10 is caused to vary with the aid of force generating means acting between the outer part 17 of the inner part 7 and the inner part 18 of the outer part 10. Fig. 16 illustrates diagrammatically a pivot joint 22, such as a hinge, and a force generating means in the form of one or more hydraulic piston-cylinder devices 23 acting between the attachments 26, 27 in respective bridge parts.

According to a further preferred embodiment of the invention, the inner part of the passenger bridge 7 is hinged to the rotunda 9, so as to enable the bridge to be swung in a vertical plane, see fig. 4-6. The vertical position of the inner part 7 of the bridge is caused to vary with the aid of lifting means 24 adjacent the drive means 12. The lifting means, shown in fig. 7 has the form of a hydraulic piston-cylinder device 24.

Alternatively, the rotunda 9 may be raisable and lowerable so as to be able to take different vertical positions.

The rotunda is supported by a ground-mounted vertical pillar. When the rotunda can be raised and lowered, the rotunda 9 is supported by a ground-mounted vertical pillar 25 that includes lifting means, such as a hydraulic piston-cylinder device, for changing the length of the pillar and therewith displacing the rotunda in a vertical direction.

However, it is preferred that the inner part of the passenger bridge 7 is hinged to the rotunda 9 so as to enable the bridge to be swung in a vertical plane, and that the vertical position of the inner bridge part can be caused to vary with the aid of said lifting means 24 at the drive means 12.

According to a highly significant embodiment of the invention, the inner part 7 of the bridge and its outer part 10 are caused to take a vertical position in which the bridge 4 will pass freely over the upper side of the wing 6 prior to moving the bridge 4 in over the wing 6 of the aircraft and subsequent to having moved the bridge 4 in over the wing.

This is shown in fig. 4-6, of which fig. 4 illustrates a starting position where the aircraft is parked; see also fig. 2. The reference numeral 28 marks the outmost tip of the wing 6. Fig. 5 illustrates the position where the drive means has been driven to a position close to the leading edge of the wing 6 during telescoping of the inner part of the bridge. Fig. 6 shows the outer part of the bridge being telescoped and lowered into docking position with a rear door A4 on the lower deck, as shown in fig. 3.

Fig. 8 illustrates from above the state in which the passenger bridges of fig. 2 have been docked to both forwardly located doors and a rearwardly located door A4 on the lower deck.

The passenger bridges 2 and 3 are conventional telescopic bridges. These bridges can also be swung in a vertical plane with the aid of lifting means at respective drive means 12 for

connection of the bridges with forwardly located doors at different heights above ground level.

Fig. 10-12 illustrate a sequence corresponding to that illustrated in fig. 4-6, although in this case the passenger bridge 4 is shown docked to a rearwardly located door A8 on the upper deck.

Fig. 13 illustrates from above the state in which the bridges shown in the figure have been docked to both forwardly located doors and a rearwardly located door A8 on the upper deck.

Fig. 14 is a side view of the forwardly located passenger bridge 2 docked to a forwardly located door A7 on the upper deck.

Fig. 15 is a side view of the forwardly located bridge 2 docked to a forwardly located door A2 on the lower deck.

The passenger bridge 4 can be docked to rearwardly located doors on both the upper and lower deck, by virtue of the fact that the bridge 4 can be raised to an extent such as to allow the drive means 12 to reach the region of the leading edge of the wing of the aircraft in combination with the ability to fold down the outer part 10 of the bridge 4 relative to the inner part 7 of said bridge. Docking is achieved relatively quickly, since the passenger bridge is moved to a limited extent on the ground from its starting position to its end position at the leading edge of the wing. In addition, two other passenger bridges are docked to two other forwardly located doors at the same time.

It is obvious that the present invention solves the problems in the introduction.

Although the invention has been described with reference to a number of exemplifying embodiments thereof, it will be obvious that these embodiments can be varied. For example, the passenger bridge drive means may include more than one wheel pair and more than one support means. Furthermore, the bridge 4 folding means may have some

other design. In addition, the outer part 10 of the passenger bridge may be provided with a downwardly foldable vertical support at its outer end, such as an hydraulically operated support.

The present invention shall not therefore be considered limited to the aforedescribed and illustrated exemplifying embodiments thereof, since variations and modifications can be made within the scope of the following claims.